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Patentanmeldung Nr. Patent application No. Demande de brevet n°

02013085.2

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Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
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Wideband antenna for small portable devices

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WIDE BAND ANTENNA FOR SMALL PORTABLE DEVICES

Technical field

The present invention relates to an antenna configuration for use in a small portable device with a good performance allowing it to be used for different communications protocols. Antennas need sufficient bandwidth to meet demands of protocols and sufficient efficiency to reduce power consumption of the device so it can operate longer on a small battery.

Known Prior Art

There are several know solutions for antennas for small portable devices. Examples of such devices are headsets for electronic apparatuses, Bluetooth devices, or any small electronic device communication wirelessly.

One example of an antenna for small portable devices is a monopole antenna, which sticks out of the product. Another solution is a PIFA antenna. There are several manufacturers that produce small antennas, such as Mitsubishi. The drawback of all these antennas is that they all need ground planes too big to achieve sufficient bandwidth in a small portable device. The efficiency of these antennas are also poor except for the monopole antenna.

There are a number of problems with the known prior art, which makes them unsuitable to use in a small portable device:

Firstly, the size of the product (small portable device) causes problems for antenna design. A small portable device has limited battery capacity. This means that the antenna should have a high efficiency in order not to waste battery power. Small antennas have worse efficiency than big antennas. Because the device is small, the ground plane will be small as well. Antennas need a certain ground plane size to achieve a certain bandwidth, which is necessary for the antenna to be able to operate under a specific communications protocol, which always demands a certain bandwidth.

Secondly, since cost is often important for small portable devices it is important that the antenna can be made cheaply, which is not always the case with the antennas known in the art.

Thirdly, because of the small nature of the small portable device, other parts of the device will be very close to the antenna, which can have a negative influence on the antenna performance. Especially conducting materials like batteries, knobs or ESD (electrostatic discharge) means can have a very negative influence on the antenna performance. The antenna has to work well in this environment, which is also not possible with the antennas according to the known prior art.

Summary of the invention

The object of the invention is to provide an antenna being sufficiently small to fit in a small portable device, which has good performance in at least one frequency band. The configuration of the antenna with all the essential components yields optimal antenna performance. The above object is met with an antenna design meeting all the important criteria for a good antenna, while keeping all the necessary functionality demands needed for a small portable device. Bandwidth, efficiency, cost, size and ESD protection are all more than adequate. The low possible height of the antenna allows maximum freedom for the visual design of the product as well. The antenna design is also easy to match to a 50 Ohm impedance needed for good RF performance.

Brief description of the drawing

A presently preferred embodiment of the present invention will be described in the following detailed disclosure, reference being made to the accompanying drawing, in which:

Fig. 1 illustrates a first embodiment of the antenna according to the invention.

Solution

In Fig. 1 the configuration of the antenna and other essential components for small portable devices are shown.

There are several parameters to this antenna configuration. The antenna 2 can only be mounted in the drawn direction and its connections should be as close to the PCB 1 edge as possible. The position of the battery 4 in relation to the antenna 2 is fixed as well.

The PCB 1 can be made out of all the known PCB materials and layers, as long as one layer is used as a dedicated RF (Radio Frequency) ground plane, which also serves as a ground plane for the antenna.

The antenna 2 is a loop antenna that is made out of a metal sheet. Any well conducting material can be used. The antenna loop 2 could in an alternative embodiment also be made as a loop inside the PCB at the cost of efficiency. Still another embodiment is to provide the antenna loop 2 as a component formed as a U-shaped dielectric with the antenna shape etched onto it (like a thick PCB), making it suitable for SMT (Surface Mounted Technology) pick and place machines. The antenna loop 2 comprises a first portion 6 having a first and a second end, extending in a first direction along the PCB 1. A second portion 7, having a first and a second end, is at the first end connected to the second end of the first portion 6. The second portion 7 extends in a second direction, substantially perpendicular to the first side of the PCB, towards a second side of the PCB. A third portion 8 of the antenna loop 2, having a first and a second end extends along the second side of the PCB in the opposite direction of the first direction of the first portion 6. The first end of the third portion 8 is connected to the second end of the second portion 7. The first end of the first portion 6 and the second end of the third portion 8 are connected to radio circuitry on the PCB 1.

A first bezel 3 is optional and can be used for fending off ESD discharges. The Bezel does not influence the antenna performance much.

A Battery 4 can be of any configuration, technology or size suitable with the small portable device.

To improve ESD robustness, a second bezel 5 can be place all around the PCB without negatively influencing the antenna performance.

The configuration of the antenna 2 with all the essential components yields optimal antenna performance. All the important criteria for a good antenna are met while keeping all the necessary functionality demands needed for a small portable device. Bandwidth, efficiency, cost, size and ESD protection are all more than adequate.

As an example, the antenna 2 is suitable for portable devices communicating in the GHz range, such as Bluetooth around 2.4 GHz. Also, the antenna 2 according to the invention covers WLAN and/or protocols running in the 5 GHz ISM (industrial scientific medical) band or any other frequency or communication protocol.

The low possible height of the antenna allows maximum freedom for the visual design of the product as well. An antenna designed for the Bluetooth band including all antenna components has an length about 50 mm, an width of about 12 mm, indicated with L, W, respectively, in Fig. 1, and an height about 5 mm. As should be realized by the man skilled in the art, an antenna designed for the 5 GHz ISM band is half as big as the Bluetooth antenna, since a doubled radiating frequency halves the size of the antenna 2.

The antenna design is also easy to match to a 50 Ohm impedance needed for good RF performance.

CLAIMS

1. An antenna device for a small portable device adapted to provide resonance in at least a first frequency band, the antenna comprising an antenna loop (2) of conducting material, and a PCB (1), **characterized** by

a first portion (6) having a first and a second end, said portion (6) is extending in a first direction along a first side of the PCB (1);

a second portion having a first and a second end, the first end of the second portion (7) is connected to the second end of the first portion (6), said second portion (7) is extending in a second direction from the first side of the PCB (1) towards a second side of the PCB (1), which is opposite the said first side; and

a third portion (8) having a first and a second end, the first end of the third portion (8) is connected to the second end of the second portion (7), said third portion (8) is extending in the opposite direction of said first direction of the first portion (6) along said second side of the PCB (1).

2. The antenna according to claim 1, wherein the antenna comprises a first bezel extending from the first side of the PCB to the second side of the PCB.

3. The antenna according to any of the claims 1 or 2, wherein a second bezel extends along at least one side of the PCB.

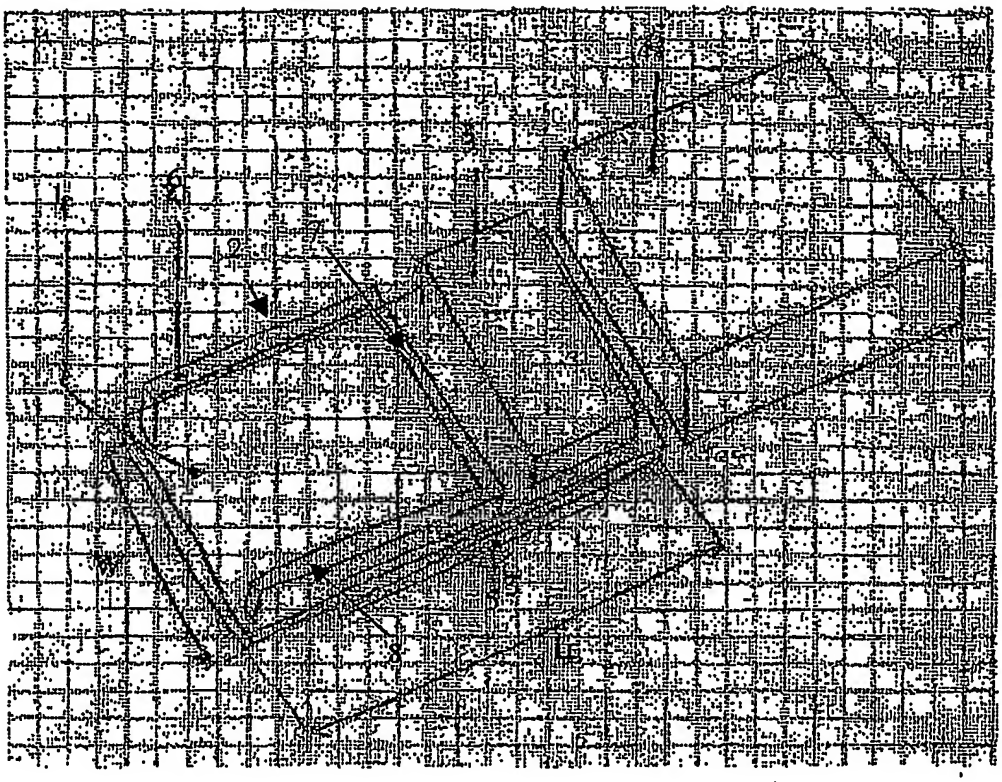

Fig. 1